

REMARKS

In view of the above amendments and the following remarks, reconsideration of the outstanding office action is respectfully requested.

Pursuant to 37 CFR § 1.21, attached as an Appendix is a version which contains markings to show changes made to the claims.

Applicants hereby confirm that an election to prosecute the invention of group I, claims 1-39, was made with traverse. Applicants hereby traverse on the grounds that all groups of invention identified in the outstanding office action are closely related and, despite the indication by the U.S. Patent and Trademark Office ("PTO") of their separate classification, would require common areas of search and consideration. For example, in searching the invention of group I, both class 428, subclass 36.9+ and class 423, subclass 447.7 should be searched. Accordingly, no benefit is derived from maintaining the restriction requirement and withdrawal of the restriction requirement is respectfully requested.

Applicants also confirm their election of the following species: a field emission display. Claims reading on the elected species include claims 1-6, 9-26, 29-37, 78, and 87-89. Applicants traverse the election of species requirement on the basis that claims reading on the elected species are allowable for the reasons set forth below and, therefore, the claimed invention should be examined to the full extent of the recited genus.

The rejection of claim 78 under 35 U.S.C. § 112 (second paragraph) for indefiniteness is respectfully traversed in view of the above amendments.

The rejection of claims 37-39 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,547,343 to Ajayan et al. ("Ajayan") is rendered moot by the cancellation of claims 38-39 without prejudice and respectfully traversed with respect to claim 37.

Ajayan does not teach a process for preparing carbon nanotubes, but instead teaches only a process for filling previously formed nanotubes and the resulting filled carbon nanotubes. Ajayan begins with previously formed nanotubes, which include a central, hollow tubule. The top portion of the carbon nanotube, with its hollow tubule, is subjected to an evaporation of a suitable amount of foreign material (Ajayan, col. 5, lines 48-50). The top portion of the carbon tubule is further subjected to heat treatment at a temperature over a melting point of the foreign material under atmosphere until the top portion of the tubule is broken by the reaction with the foreign material whereby the opening is formed at the top

portion of the carbon tubule (Ajayan, col. 5, lines 50-55). The foreign material melted by the heat treatment flows through the opening at the top portion into the center hollow space and this is continued until the center hollow space is filled (Ajayan, col. 5, lines 55-62).

Ajayan also illustrates a plurality of nanometer sized carbon tubules enclosing gadolinium and cobalt, which are arranged in an array on a glass substrate (see Ajayan, Figure 3 and col. 12, lines 50-53). However, Ajayan does not provide any evidence that the carbon nanotubes were grown on the glass substrate. Specifically, Ajayan states that they are merely “arranged” thereon (Ajayan, col. 12, line 51) and that “[a] magnetic field is applied on the glass substrate 31 for an application of the solvent including the carbon tubules 32 enclosing the magnetic material on the glass substrate 31 and a subsequent dry treatment thereof” (emphasis added) (Ajayan, col. 12, lines 62-65). Because Ajayan teaches a solvent coating process for arranging carbon tubules on a glass substrate, Ajayan fails to provide any evidence that the glass substrate is one which inherently has a strain point or melting point temperature within the claimed range (“between about 300°C and 700°C”). Thus, the cited text of Ajayan provides no support for the PTO position set forth at page 6 of the outstanding office action.

The standard for determining inherency, as adopted by the Federal Circuit in Continental Can Co. USA, Inc. v. Monsanto Co., is as follows:

Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

948 F.2d 1264, 1268-69, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991) (emphasis in original) (citing In re Oelrich, 666 F.2d 578, 581 (CCPA 1981)). Applicants submit that Ajayan leaves much open to speculation as to whether the glass substrate, illustrated in Figure 3 and described in Example 12 thereof, necessarily possesses the claimed strain point or melting point temperature. After all, different glass compositions will have different characteristics, including strain point and melting point temperatures. Because Ajayan neither identifies the contents of the glass substrate nor subjects the glass substrate in Example 12 to heating of any kind, there is no basis to conclude that the glass substrate necessarily has a strain point or melting point temperature within the claimed range. That the glass substrate could possibly have a strain point or melting point temperature within the claimed range, however, is irrelevant. See In re Oelrich, 666 F.2d 578, 581, 212 USPQ 323, 326 (CCPA 1981) (holding

that inherency must flow as a necessary conclusion from the prior art, not simply a possible one).

To have met its burden in demonstrating that a reference inherently teaches a particular feature, the PTO must provide factual and technical grounds which establish that the “inherent feature” necessarily flows from the teachings of the prior art. See Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Interf. 1990). Applicants submit that Ajayan clearly fails to satisfy the standard set forth by the Federal Circuit in Continental Can and, moreover, the PTO has failed to provide factual and technical grounds which support its position. For these reasons, the rejection of claim 37 should be withdrawn.

The rejection of claim 78 under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 5,726,524 to Debe (“Debe”) is respectfully traversed.

Debe teaches an electron field emission display including an electrode comprising as cathode a layer comprising a dense array of discrete solid microstructures disposed on at least a portion of one or more surfaces of a substrate, with at least a portion of the microstructures being conformally overcoated with one or more layers of an electron emitting material (Debe, col. 2, lines 39-48). Debe teaches using organic and inorganic materials (including glasses, ceramics, metals, and semiconductors) as substrate materials (Debe, col. 8, lines 27-30). The microstructures are formed of an organic material, which is deposited as a thin layer onto the substrate and then annealed to form microstructures thereon (Debe, col. 8, lines 12-21 and 50-61). Debe lists a number of polymeric and pre-polymeric organic materials at col. 8, line 62 to col. 9, line 11; however, Debe notes that the microstructures are not formed of carbon *per se*. Rather, Debe specifically states that “the chemical composition of the organic-based microstructured layer will be the same as that of the starting material” (col. 9, lines 12-14). This is in sharp contrast to the carbon nanotubes formed according to the present invention, which—having been formed from a carbon source gas as described at page 9, lines 26-28 of the present application—are truly carbon nanotubes.

Claim 78 presently recites a field emission display which includes “a baseplate having an electron emitting array positioned thereon, the baseplate comprising a substrate and a one or more free-standing carbon nanotubes originating and extending outwardly from an outer surface of the substrate”. Because Debe fails to teach or suggest a baseplate having a carbon nanotube (i.e., as opposed to a microstructure formed of a polymer or pre-polymer organic material), Debe cannot anticipate claim 78. Therefore, the rejection of claim 78 is improper and should be withdrawn.

The rejection of claims 1-37 under 35 U.S.C. § 103(a) for obviousness over Ajayan in view of Chen et al., "Well-aligned Graphitic Nanofibers Synthesized by Plasma-Assisted Chemical Vapor Deposition," Chemical Physics Letters 272:178-182 (1997) ("Chen") is respectfully traversed.

Ajayan is cited substantially as described above.

Chen reports the preparation of carbon nanotubes on a nickel wafer using mixed nitrogen and methane gases during plasma-assisted hot filament chemical vapor deposition (Chen, page 179, first column). During the nucleation stage, when plasma is generated, the substrate temperature reached 900-950 °C (Id.). During the fiber growth stage, substrate temperature was reduced to about 800 °C (Id.). Chen also notes that these temperatures are necessary, because "[n]o carbon fibers can be grown if the temperature drops below 900 °C in conventional CVD using methane as the carbon source" (Chen, page 182, first column).

The PTO has taken the position that the strain point or melting point temperature as presently recited in claims 1, 21, and 37 is "inherent in the teachings of either Chen et al. or Ajayan et al." (office action, page 8). Applicants respectfully disagree.

First and foremost, whether a feature is inherent in a prior art reference is irrelevant to the question of obviousness. It has been repeatedly stated by the Court of Claims and Patent Appeals, predecessor of the Federal Circuit, that a feature "which may be inherent is not necessarily known" and that "obviousness cannot be predicated on what is unknown." In re Shetty, 566 F.2d 81, 86, 195 USPQ 753, 757 (CCPA 1977) (quoting from In re Spormann, 363 F.2d 444, 448, 150 USPQ 449, 452 (CCPA 1966)).

Moreover, applicants have already demonstrated that the claimed strain point or melting point temperature range is not inherent in Ajayan. Ajayan simply fails to provide any basis for the conclusion that the glass substrate (described in Example 12 of Ajayan) necessarily has a strain point or melting point temperature as claimed and the PTO has provided no evidence in support of its position.

Finally, Chen actually teaches away from the use of a substrate having strain point or a melting point temperature between about 300 °C and 700 °C. Chen utilized a nickel substrate; it is well known that nickel has a melting point of about 1455 °C. The substrate temperature which Chen utilized in preparing the carbon nanotubes was about 900-950 °C during the nucleation stage (Chen, page 179, first column) and 800 °C during the fiber growth stage (Id.). Chen also states that these temperatures are necessary, because "[n]o carbon fibers can be grown if the temperature drops below 900 °C in conventional CVD using

methane as the carbon source" (Chen, page 182, first column). Given the process requirements of Chen, Chen fails to provide any motivation for modifying the process to allow its use on otherwise unsuitable substrates.

Thus, one of ordinary skill in the art would not have chosen a glass substrate having a strain point or melting point temperature as recited in claims 1, 21, and 37. As noted in the present application at page 2, lines 21-30, high temperature requirements for previously reported methods of carbon nanotube formation had limited the choice of suitable substrates, particularly with regard to flat panel displays. A glass produced by Corning Incorporated (Corning, New York) had, at least at the time the present application was filed, the highest known flat panel display glass deformation or strain point temperature of 666 °C (Id.). Typically, commercially available flat panel display glass have a strain point temperature between 500 °C and 590 °C (Id.). If materials such as these were to be employed as substrates in the process of Chen, which utilized temperatures of about 900-950 °C during the nucleation stage (Chen, page 179, first column) and 800 °C during the fiber growth stage (Id.), then the glass substrate likely would have deformed, inhibiting aligned carbon nanotube growth. As noted at page 1, lines 14-23 of the present application, maintaining the aligned carbon nanotube growth is important for flat panel displays and other products. Thus, the process as taught by Chen would have been unsuitable for use in preparing a product as presently recited in claims 1, 21, and 37.

Because Chen and Ajayan both fail to suggest alternative methods for formation of carbon nanotubes which can be performed at temperatures suitable for use with substrates "having a strain point or a melting point temperature between about 300°C and 700°C" as recited in claims 1, 21, and 37, neither Chen nor Ajayan, alone or in combination, teach or suggest each and every limitation of the product as presently claimed.

In view of the all of the foregoing, applicants submit that this case is in condition for allowance and such allowance is earnestly solicited.

Respectfully submitted,

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